Scientific Research Publishing

Case Reports in Clinical Medicine, 2020, 9, 131-136
https://www.scirp.org/journal/crcm
ISSN Online: 2325-7083
ISSN Print: 2325-7075

Intradural Disc Herniation Can Be Intra-Arachnoid or Extra-Arachnoid: 2 Case Reports with MRI Diagnosis and Non-Surgical Management

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How to cite this paper: Mailleux, P., Lambert, A. and Milbouw, G. (2020) Intradural Disc Herniation Can Be Intra-Arachnoid or Extra-Arachnoid: 2 Case Reports with MRI Diagnosis and Non-Surgical Management. *Case Reports in Clinical Medicine*, **9**, 131-136.
https://doi.org/10.4236/crcm.2020.95019

Received: April 10, 2020
Accepted: April 26, 2020
Published: April 29, 2020

Abstract

Intradural disc herniation is rare and often diagnosed during surgery. We present two patients with the disease, one with an intra-arachnoid type, the other with an extra-arachnoid location. The teaching point of those cases is that this very frequent pathology can take a variety of forms, depending on the structures that are infiltrated. The key point in correctly diagnosing the intradural disc herniation is to look at the angle between the fragment and the dura. Is it pushing it (as in the usual disc herniation), embedded in it (those with the extra-arachnoid type) or does it go through to fall into the CSF (In the intra-arachnoid type)? It could be diagnosed on MRI preoperatively. Contrary to many published cases of intradural disc herniation, the two patients could be managed non-surgically.

Keywords

Intradural Disc Herniation, MRI, Intra-Arachnoid, Dura Mater

1. Introduction

The very rare intradural disc herniation (IDDH) is defined as a nucleus pulposus fragment of the intervertebral disc intruding through the dural sheath into the thecal sheath. Patients are typically males in their fifties who experienced acute exacerbation of low back pain followed by the rapid onset of a focal motor deficit. Many of the published patients have been operated [1].

It used to be an intra-operative finding, sometimes suspected on MRI. Two different varieties were distinguished: the intradural intra-arachnoid disc herniation (IDIADH) when the nucleus pulposus fragment perforates the posterior longitudinal ligament (PLL) to enter the cerebrospinal fluid (CSF) where it is surrounded by the nerve roots, or the intradural extra-arachnoid disc herniation (IDEADH) variety when the fragment becomes embedded into the layers of the anterior dura mater, just behind the PLL, and does not enter the CSF. Various MRI signs were described: the sagittal Y sign of the extra-arachnoid form [2] [3], the crumble disc sign of the intra-arachnoid type [4].

In the following two cases, the patients presented with initially with lower back symptoms followed later by sciatica without motor or sphincter deficit. The MRI exams clearly showed IDDH, one of the intra-arachnoid, one of the extra-arachnoid type. Contrary to most of the IDDH published patients, the clinical symptoms subsided without any need of surgery, and are well at 2 and 6 years of follow-up.

2. Case Reports

Patient 1. A 78 year old male patient presented with chronic lumbar back pain and recent left L5 sciatica. He had an history of lumbar spinal surgery for spinal stenosis at the level of L3-L4 and L4-L5 in 2004 and of lumbar discal hernia surgery at L2-L3 in 2012. There was no cancer history.

Comparison between 2012 MRI and 2018 MRI showed a substancial difference (**Figure 1**). While there was a left posterolateral disc protrusion in 2012 (**Figure (1A)**, **Figure (1B)**), in 2018 there is a mass, with intermediate signal on T1 and T2, (**Figure (1C)**, **Figure (1D)**) located behind the longitudinal posterior lumbar ligament (PLL) and behind the dura mater, inside the cerebro-spinal fluid (CFS), surrounded by the nerve roots, quite distinct of the nerve roots. There was no

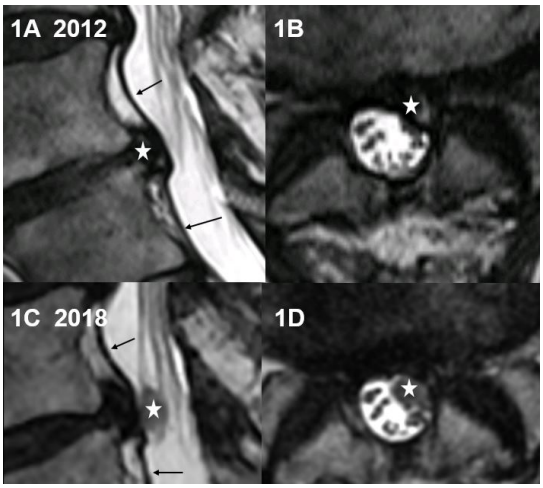

Figure 1. (1A) and (1B) are MRI images from 2012: sagittal T2, axial T2. They show subligamentar left posterolateral disc protrusion. PLL(thin arrows), disc protrusion (star). (1C) and (1D) are MRI images from 2018: intradural disc herniation (square) behind the PLL (thin arrows).

history of cancer, and the diagnosis of intradural disc herniation (IDDH) was proposed, of the intra-arachnoid type (IDIADH).

A few weeks later, the symptoms of left sided sciatica subsided, with persistence of lumbar back pain, and, the patient was not operated upon. Two years later, the patient remains asymptomatic.

Patient 2. A 49 year old male patient with a one year old history of left sciatica, and a recent more severe right sciatica. Lumbar spine MRI showed a large ascending disc herniation originating from the L2-L3 disc and going up over a height of 45 mm, behind the body of L2 and behind the L1-L2 disc. On the sagittal images, the classical "Y sign" [2] is not visible, but we see a similar finding on the axial T2 images (**Figure (3F)**, **Figure (4D)**, **Figure (5B)**), that could be called specific axial magnetic resonance imaging of intradural extra-arachnoid lumbar disc herniation: the disc herniation is clearly embedded in the anterior dura mater dehind the L2 vertebral body. The **Figure (4B)** and **Figure (5B)** clearly show the disc herniation situated in the dura mater and not in the PLL, with an obtuse or right angle which implies it is developped inside the dura mater and not inside the PLL or between both structures (**Figure (4B)**).

The patient had no deficit, postponed surgery, and symptoms resolved after 3 months with medical treatment alone. The patient is still asymptomatic 6 years later.

3. Discussion

In the natural history of disc pathology, intradural disc herniation is a rare event. This condition was first described by Dandy in 1942 and is frequently associated with symptoms worse than those of usual lumbar disc herniation. In large series they represent from 0.3% to 1.5% of the cases [2]. They are frequently operative findings, but more specific MRI signs have been described, allowing preoperative diagnosis [2] [4]. In some series [5], there is a higher incidence of cauda equina syndrome than in extradural disc herniation, and their surgical treatment requires a transdural approach.

Most the the cases happen in the lumbar area, with only 5% in the thoracic spine and 3% in the cervical spine. The L4-L5 intervertebral disc region is more frequently involved, which could have different explanations: the dura mater at this level is the closest to the PLL and the L4-L5 intervertebral disc is under the greatest biomechanical pressure [6]. In some series, there is a higher frequency of history of disc surgery, which could explain some fibrosis in the planes between PLL and dura mater [7]. Our first patient had two episodes of spinal surgery and 4 lumbar corticoid injections that could have fragilized the collagenous tissues.

IDDH can be divided anatomically into two subtypes [2]. the intradural extra-arachnoid disc herniation (IDEADH), where the disc fragments slips into the layers of the dura mater without breaking through and without entering the cerebro-spinal fluid (CSF) and a more frequently encountered intradural intra-

arachnoid disc herniation (IDIADH) where the fragments falls into the CSF, where it is surrounded by the nerve roots.

We describe two patients, one with IDEADH, the second with IDIADH, with specific MRI signs allowing the diagnosis in both cases.

The nucleus pulposus, major component of the disc herniation is a jelly-like material that consists of mainly water, as well as a loose network of collagen fibers [8]. In the case of disc herniation, when it goes off beyond the disc boundaries, it usually has a rounded globular appearance with sharp smooth borders, because it is always pushing against some other resistant material: outer fibrous part of the disc, posterior longitudinal ligament, dura mater and nerve roots in the epidural or foraminal fat. But when the disc fragment breaks through PLL and dura mater to become an IDIADH, entering the CSF fluid, between the nerve roots, those structures do not exercize any counter pression. That explains changes in structure and shape: The IDIADH will look somewhat less dense and homogeneous, it can more easily fragment and take the "crumble" appearance [7], or, as in our case, presents with blurry borders (**Figure (1C)** and **Figure (1D)**, **Figure (2A)**, **Figure (4A)**, **Figure (5A)**).

In the second patient, with IDEADH, MRI images are totally different and equally specific: the disc frament originating from the L2-L3 disc level does not break through all layers of the PLL and dura mater: it enters the dura mater layers, going up 45 mm. That intra-arachnoid topography is attested by the axial slices in **Figure 3**, **Figure 4** and **Figure (5B)**. The angle from the dura mater is not explainable with an extrinsic mass, it has to be embedded in the dura mater. That sign could be a specific MRI sign of IDEADH, an assumption which needs confirmation with further studies.

4. Conclusion

Images analysis can help us in the preoperative diagnosis of IDDH. In the case of IDIADH where MRI shows the intra dural localization of an irregular, sometimes

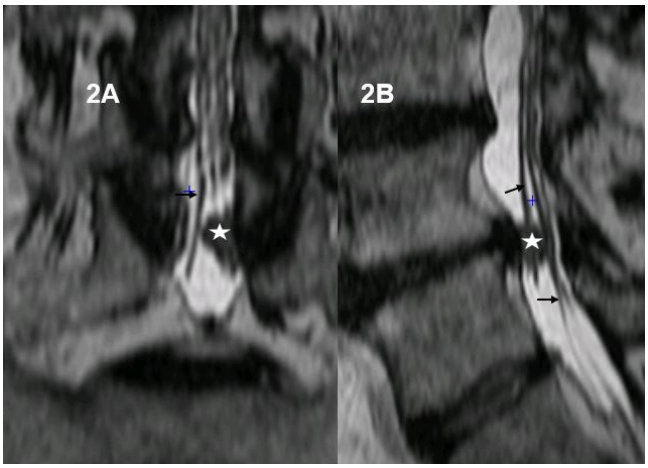

Figure 2. T2 reformated images (2A): coronal, (2B) sagittal. Disc herniation (star) is distinct of the nerve roots (thin arrows). It is located inside the CSF.

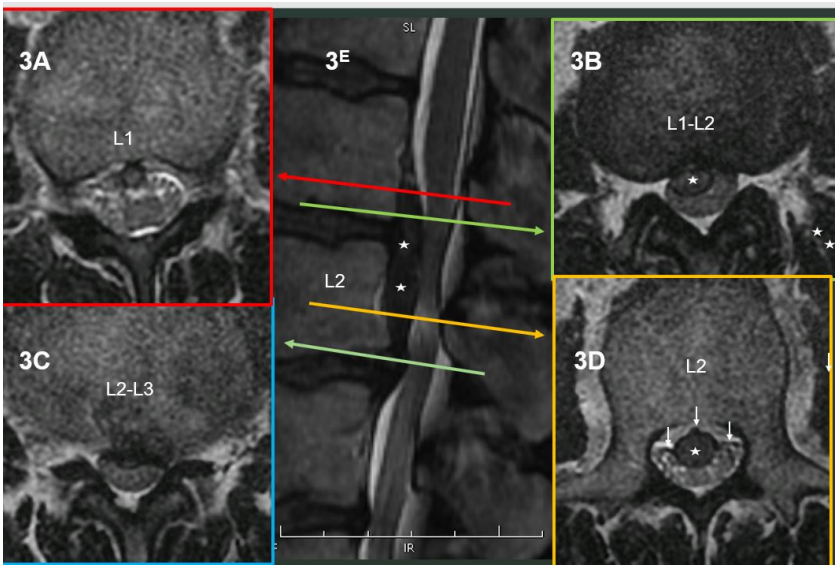

Figure 3. Axial T2 slices from L1 (3A) to L2-L3 (3C). The disc herniation (star) is embedded into the anterior dura (arrows), (3E): sagittal T2 slice shows the longitudinal extend of the disc herniation (star).

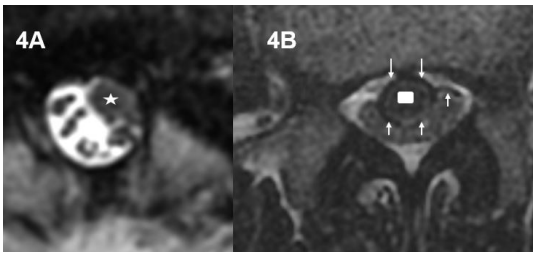

Figure 4. (4A) Patient 1, T2 axial slice at the level of the intra-arachnoid disc fragment (star), inside the dural sac. (4B) Patient 2, T2 axial slice at the level of the intra-arachnoid fragment (square), embedded in the dura (thin arrows). Note that there is very little CSF at that level.

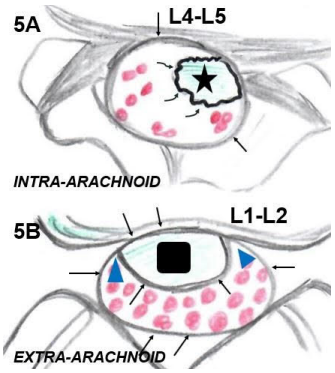

Figure 5. (5A) Drawing of IDIADH on axial slice. Intra-arachnoid fragment (star) has blurry borders (curved arrows), is located inside the dura (arrows) surrounded by CSF and nerve roots (red dots). (5B) Drawing of the IDEADH. The extra-arachnoid fragment (square) is not surrounded by CSF but embedded in the anterior dura (arrows). It has convex smooth borders. Angles with the dura (small blue triangles) are not compatible with extrinsic compression. Due to the large disc herniation, there is minimal CSF around the nerve roots (red dots).

fragmented mass [6], with blurry borders, distinct of the nerve roots. While in the rare IDEADH, the location of the disc fragment can be proved by the classical sagittal Y sign [2], or, in our second case, by the angle between the disc herniation and the dura on the axial slices. The key point in correctly diagnosing the intradural disc herniation is to look at the angle between the fragment and the dura. Is it pushing it (as in the usual disc herniation), embedded in it (those with the extra-arachnoid type) or does it go through to fall into the CSF (In the intra-arachnoid type)? Contrary to the majority of IDDH patients earlier published, the two patients could be managed without surgery.

Consent

Informed consent was obtained from both patients.

Conflicts of Interest

The authors have no competing interests to declare.

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